

## Cap and Escape in Trade Agreements<sup>†</sup>

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*We propose a model of flexible trade agreements in which verifying the prevailing contingencies is possible but costly. Two types of flexibility emerge: contingent protection, which requires governments to verify the state of the world, and discretionary protection, which allows governments to set tariffs unilaterally. The structure of the GATT/WTO agreement provides these two types of flexibility through a mechanism that we call Cap and Escape. Governments may choose tariffs unilaterally below the negotiated cap, but escaping from the cap requires state verification. We show that this framework explains key features of the GATT/WTO agreements, including the substantial variation across sectors and countries in the level of negotiated tariffs, and the rate at which different flexibility measures are used.* (JEL D86, F11, F13, F41)

A remarkable trend in international relations since the end of the World War II has been the willingness of sovereign states to limit their economic policy space under the auspices of various international trade agreements. The economics literature has shed light on this trend by showing that these agreements could help governments avoid beggar-thy-neighbor policies (Bagwell and Staiger 1999; Ossa 2011) and short-term protectionist temptations (Maggi and Rodriguez-Clare 1998, 2007).<sup>1</sup> Nevertheless, the existing agreements also contain a number of features that provide a varying degree of trade policy flexibility across countries and sectors that are largely overlooked by the standard literature. In this paper, we show that in order to explain the observed patterns of negotiated tariffs, it is crucial to understand these flexibility mechanisms.

The governments have retained flexibility under the WTO agreement in two major ways. First, in many sectors, the negotiated tariff binding rates are sufficiently high

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<sup>1</sup>The idea that trade policy may be used by one country to gain an advantage at the expense of another country (i.e., the beggar-thy-neighbor policy) is elaborated by Johnson (1953) and Venables (1987). Bagwell and Staiger (1999) and Ossa (2011) further show how trade agreements could eliminate these inefficient policies. Maggi and Rodriguez-Clare (1998, 2007) show that trade agreements could further improve welfare by overcoming a time-inconsistency problem in the choice of trade policy.

TABLE 1—FLEXIBILITY IN THE FORM OF OVERHANG AND ESCAPE

	Number of products	Share (percent)	Imports (bil \$)	Share (percent)
Positive tariff overhang	225,335	54.15	1,885	22.07
Zero tariff overhang	99,792	23.98	5,570	65.21
Unbound	91,029	21.87	1,087	12.72
Total	416,156	100	8,542	100
Safeguard initiated	1,618	0.39	110	1.28
Safeguard adopted	681	0.16	70	0.82

Notes: Data from 106 WTO members. Tariff overhang is calculated using applied rates in 2007.

that they give governments the flexibility to set their tariffs unilaterally under the binding. This creates a gap between the applied and negotiated tariffs that is known as *tariff overhang*. Another form of trade policy flexibility is provided through contingent protection measures such as safeguard and antidumping. As shown in Table 1, 54 percent of sectors worldwide had a positive tariff overhang in 2007. Moreover, between 1995 and 2010, the governments have initiated safeguard cases that affected more than 1,600 six-digit sectors.

The objective of this paper is to propose a model of flexible trade agreements in which verification of contingencies is possible but costly. In particular, we study the properties of the optimal “cap-and-escape” agreement, which is the common structure of the existing trade agreements.<sup>2</sup> We work within a simple political-economy trade model in which the government’s trade policy preferences are subject to shocks, and the governments are privately informed about the realization of these shocks. Furthermore, we assume that the government’s private information may be verified through a costly state verification process.<sup>3</sup>

Under the cap-and-escape agreement, unilateral and conditional flexibility measures are substitutable. An increase in the degree of unilateral flexibility, which is obtained by a higher tariff binding, decreases the scope for conditional flexibility. The optimal level of tariff binding, therefore, strikes a balance between the negative externality generated by unilateral flexibility and the cost of state verification in case of conditional flexibility.

Our main theoretical result links the optimal level and type of flexibility to two key parameters: the level of international externality, and the cost of state verification.

<sup>2</sup>Some form of escape clause has been a long-standing feature of international trade agreements. The US-Mexico trade agreement of 1942, negotiated as part of the US Reciprocal Trade Agreements Act (RTAA), included a clause indicating that trade concessions could be withdrawn as a result of unforeseen developments and of trade concessions that resulted in increased imports and damage to the domestic industry. When the RTAA came up for renewal in 1945, the US Congress exerted pressure on President Truman to include an escape clause in all future agreements. An escape clause with a language very similar to that of the US trade agreements was included as Article XIX of the GATT. Sykes (2006) provides an excellent discussion of the history of the safeguard mechanisms.

<sup>3</sup>In order to adopt contingent protection measures, also known as Temporary Trade Barriers under the WTO, the governments are required to conduct an investigation and show that domestic industries have been injured or are likely to be injured substantially due to intense import competition. These investigations are usually very costly and time-consuming, and might lead to disputes among interested parties, which further increases the cost of adopting contingent protection measures.

In particular, for a given state verification cost, we show that the use of tariff overhang is most effective at providing flexibility in a trade agreement when the magnitude of negative externality of trade policy is small; that is, if country's noncooperative tariff is not too far from the world's optimal tariff. Conversely, when the divergence between the noncooperative and globally optimal tariff is sufficiently large, contingent protection is the optimal type of flexibility. These results imply that the greater is the divergence between the noncooperative tariff and the world's efficient tariff, the greater should be the reliance on monitoring relative to tariff overhang as a means of responding to political shocks.<sup>4</sup>

The above results have an intuitive interpretation within the standard terms-of-trade framework. The terms-of-trade theory of trade policy contends that an import tariff could depress the world prices and, thus improve the terms of trade of the importing country at the expense of foreign exporters. In particular, the divergence between noncooperative and globally optimal tariffs is increasing in the magnitude of the importing country's international market power. Our theory, therefore, implies that under the optimal cap-and-escape agreement, the tariff binding is decreasing, and the likelihood of escape is increasing, in the international market power of the importing country.

Empirical evidence from the WTO is consistent with the prediction of our model. The left panel of Figure 1 shows the relationship between tariff bindings and a measure of import market power for HS six-digit product categories across WTO member countries. Sectors with lower import market power have higher tariff bindings and, hence, a greater ability to respond to shocks by adjusting their applied tariffs unilaterally. The right panel of Figure 1, on the other hand, shows that safeguards are used more frequently in sectors with a greater import market power.

If we ignore the role of flexibility in trade agreements, these empirical observations would erroneously reject the idea that the purpose of trade agreements is to eliminate the terms-of-trade-driven prisoner's dilemma. A standard result in terms-of-trade models (e.g., Bagwell and Staiger 1999 and Grossman and Helpman 1995) is that under efficient bargaining, the negotiated tariffs are completely independent of the import market power of the countries. These predictions, however, are at odds with the observed negative relationship between negotiated tariffs and import market power. We argue that this observation does not invalidate the terms-of-trade framework; but it does highlight the importance of taking into account the desire for policy flexibility in understanding the negotiated trade agreements.<sup>5</sup>

A third prediction of the model is that reductions in the cost of monitoring will result in reductions in tariff bindings. This prediction supports the idea that having the necessary apparatus in place for using escape facilitates trade liberalization by

<sup>4</sup>These results may shed light on the issue of low participation of smaller and poorer WTO members in its Dispute Settlement Process (Bown 2005 and Shaffer 2003.) Our analysis suggests that the WTO might have been optimally designed to provide flexibility through overhang to smaller and poorer countries in order to avoid using the contingent protection measures that could cause a costly dispute.

<sup>5</sup>The standard result that optimally negotiated tariffs are independent of import market power changes when bargaining frictions are introduced. For example, Ludema and Mayda (2013) show that in sectors where the free-riding problem is significant, terms-of-trade models predict a *positive* relationship between negotiated tariffs and import market power. However, as discussed in Beshkar, Bond, and Rho (2015), this modified prediction is still inconsistent with the patterns of negotiated tariffs across WTO countries.

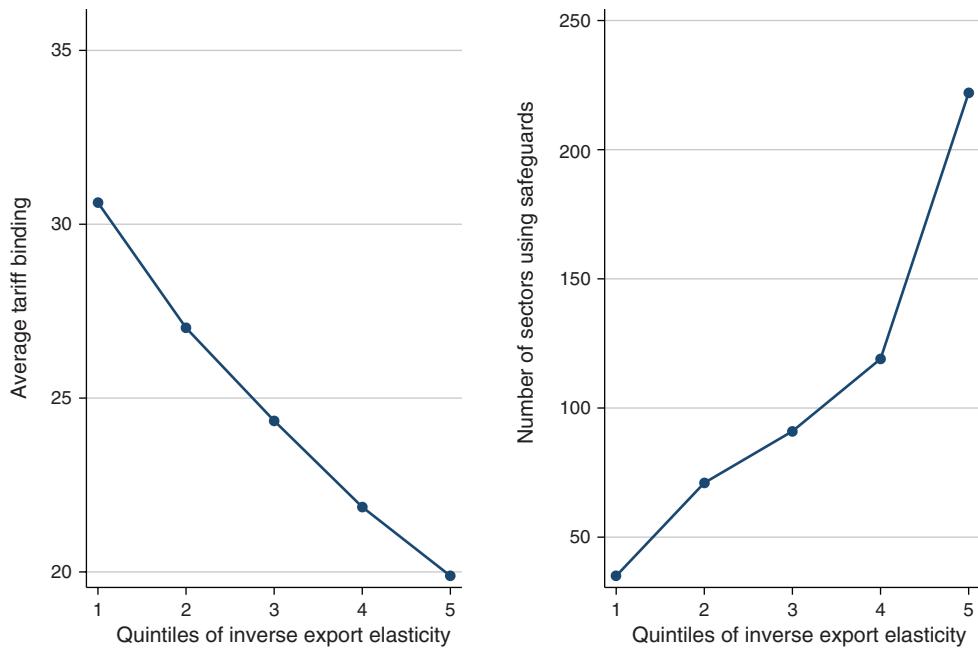


FIGURE 1

*Notes:* Average tariff binding (left panel) and the number of sectors that used safeguards (right panel) in each quintiles of import market power. Inverse of foreign export supply elasticity, as estimated by Nicita, Olarreaga, and Silva (2013), is used as the measure of a country's import market power in a given sector. The safeguard data are obtained from Temporary Trade Barriers Database (2010) and tariff data are obtained from UNCTAD TRAINS, covering 114 countries at the Harmonized System (HS) 6-digit level from 1996 to 2009.

allowing countries to commit to lower levels of tariff bindings. Kucik and Reinhardt (2008) finds that countries that have antidumping laws in place are more likely to join the WTO and have lower tariff bindings. Assuming that having antidumping laws in place lowers the cost of verification, this result is consistent with the predictions of our model.<sup>6</sup>

Our analysis is related to several strands of recent work that use an incomplete contracting approach to modeling trade agreements. Bagwell and Staiger (2005) develop a model in which the preferences of governments over tariff rates are subject to political shocks that are the private information of the importing country. In that setting, they show that the use of a weak tariff binding, which allows a country to choose its tariff at or below the binding, can yield a higher expected welfare than can be obtained by an inflexible tariff rate. Subsequently, Amador and Bagwell (2013) find conditions under which the use of a tariff binding will be the optimal incentive compatible agreement, and Beshkar, Bond, and Rho (2015) study the effect of import market power on the optimal level of binding.

The present paper takes this analysis one step further by introducing costly state verification, which enables us to study the escape clause and weak bindings

<sup>6</sup>Related results at the HS six-digit level are obtained by Pelc (2009) who shows that overhang is lower in sectors that have used trade remedies in the past.

as alternative flexibility mechanisms. To our best knowledge, this is the first study that considers the coexistence of these flexibility mechanisms in trade agreements. Considering overhang and escape within the same model is an important step toward understanding the variation in the use of escape clause across sectors and countries. In particular, the cap-and-escape model provides an explanation for the observation that sectors with greater import market power have stricter bindings and more frequent escapes.<sup>7</sup>

There are various models of trade agreement that justify the inclusion of an escape clause in trade agreements. Most of these models, including Beshkar (2010a,b, 2016), Maggi and Staiger (2015), and Park (2011), view the escape clause as a remedy system that requires compensation for escape as a way of keeping the incentives of the importing countries in check. None of these papers, however, allow for the possibility of unilateral flexibility (i.e., overhang) in trade agreement. In this paper, we assume away the possibility of transfers to focus on the trade-off between monitoring and unilateral flexibility.<sup>8</sup>

Our approach is also related to works that examine the effect of transactions costs on the optimal design of contracts. Shavell (2006) and Horn, Maggi, and Staiger (2010) have shown that when writing a contract is costly, it is optimal to craft an incomplete contract in order to save on the *ex ante* contracting efforts. Our analysis differs in that we emphasize the *ex post* costs of implementing the contract, which includes the costs of verifying the contingencies that are mentioned in the contract. As in Shavell (2006) and Horn, Maggi, and Staiger (2010), we also find that the optimal contract is incomplete, but this incompleteness is due to the costs of implementing rather than writing the contract. To the best of our knowledge, the previous literature has not explored the impact of the implementation costs on the optimal design of a trade agreement.

Our approach to verification through monitoring is similar to that in the seminal work of Townsend (1979), where an agent's private information can be observed by the uninformed party through a costly monitoring process. The optimal contracts in Townsend (1979) involve two regions: a monitoring region in which the true type is revealed and the efficient action for that type is taken, and a non-monitoring region in which agents pool and all take the same action. The cap-and-escape mechanism generates the novel result that the agents (i.e., governments in our setting) do not necessarily pool in the non-monitoring region.

Section I presents the basic political economy framework of the paper. Sections II and III analyze the optimal cap and the optimal cap-and-escape agreements, respectively. In Section IV we show that our results hold in a more general setting that does not rely on terms of trade externality. Section V presents the empirical evidence from the WTO. Finally, Section VI provides some concluding remarks.

<sup>7</sup> Within a repeated-game framework, Bagwell and Staiger (1990) determine the optimal baseline tariff and safeguard tariffs that can be selected when the import volume surges. Their model does not allow for binding overhang and does not feature monitoring, but a substitution relationship is present such that the baseline tariff can be pushed to a lower level when safeguards are available.

<sup>8</sup> Horn, Maggi, and Staiger (2010) show that another justification for an escape clause could arise when the agreement leaves some policy instruments unrestricted: an escape clause could induce governments to use import tariffs in lieu of less efficient policy instruments that are unrestricted by the trade agreement. For a survey of the literature on the escape clause, see Beshkar and Bond (2016).

## I. The Economic Setting

We use a standard two-country-many-good trade model with perfectly competitive industries in which the spillover of trade policy operates through the terms of trade. As in Bond and Park (2002), we allow for countries of different sizes. The home country's demand for good  $i$  is given by  $d_i = \lambda(1 - p_i)$  for  $i = 1, \dots, I$ , where  $p_i$  is the price of good  $i$  and  $\lambda \in (0, 1)$  is the relative size of the home country. Home supply is  $x_i = \lambda b_i p_i$ , which results in an autarky price of  $1/(1 + b_i)$ . Foreign demand is  $d_i^* = (1 - \lambda)(1 - p_i^*)$  and foreign supply is  $x_i^* = (1 - \lambda) b_i^* p_i^*$ . Therefore, the foreign country has comparative advantage in sector  $i$  if  $b_i < b_i^*$ . This model has a partial equilibrium flavor, which can be derived from a general-equilibrium model with a good 0 that absorbs all income effects.<sup>9</sup>

In light of the separability of markets, the effect of home tariff policy in one sector is independent of tariffs in other sectors. Therefore, we consider a representative home importable, where we choose  $b \equiv 1$  and let  $b^* = \beta > 1$  represent the degree of foreign country comparative advantage. Letting  $t$  be the ad valorem tariff imposed by the home country on imports, prices in the respective markets are linked by  $p = p^*(1 + t)$ . The market-clearing prices are, thus, given by

$$(1) \quad p^*(t) = \frac{1}{2\lambda(1 + t) + (1 + \beta)(1 - \lambda)}, \quad p(t) = \frac{1 + t}{2\lambda(1 + t) + (1 + \beta)(1 - \lambda)}.$$

The home country tariff improves the terms of trade of the home country. The prohibitive tariff will be  $t^{pro} = \frac{\beta - 1}{2}$ .

Following Baldwin (1987), we assume that the home country's preference over tariffs can be described by a “political” welfare function, where the government puts a weight of  $1 + \theta$  on the welfare of producers in the import-competing sector and a weight of 1 on the welfare of all other agents. We assume that  $\theta \geq 0$ , and interpret  $\theta$  as the political pressure that is exerted by the import-competing sector on the government. The political welfare function may be written as

$$(2) \quad V(t; \theta) = S(t) + (1 + \theta)\pi(t) + tp^*(t)m(t),$$

where, consumer surplus is given by  $S(t) = \lambda(1 - p(t))^2/2$ , producer surplus by  $\pi(t) = \lambda p(t)^2/2$ , and tariff revenue by  $tp^*m(t) = tp^*(t)\lambda(1 - 2p(t))$ . Increases in  $t$  have a favorable effect on political welfare by improving the terms of trade and transferring income to domestic producers of import-competing goods (when  $\theta > 0$ ). However, increases in  $t$  also reduce trade volume, which is welfare reducing

<sup>9</sup>Let the home country consist of a measure of  $N$  identical households with each household having a utility function  $U = \sum_{i=1}^n d_i(1 - 0.5d_i) + d_0$ . Households have an endowment of labor that can be allocated to production of the three goods. Letting  $l_i$  denote the quantity of labor allocated to good  $i$ , the production functions are  $x_0 = l_0$ ,  $x_1 = (2l_1)^{0.5}$  and  $x_2 = (2bl_2)^{0.5}$ . Similarly, the foreign country is assumed to have  $N^*$  households with the same preferences and production functions  $x_0^* = l_0^*$ ,  $x_1^* = (2bl_1^*)^{0.5}$ , and  $x_2^* = (2l_2^*)^{0.5}$ . Choosing good 0 as numeraire and letting  $\lambda = N/(N + N^*)$ , this structure yields the demand and supply functions in the text if the supply of labor is sufficiently large that good 0 is always produced.

when the domestic price exceeds the world price for importables. As a result of these trade-offs, home country welfare is strictly quasi-concave in  $t$  for  $t \in [0, t^{pro}]$ .<sup>10</sup>

The optimal noncooperative tariff of the home country is given by

$$(3) \quad t^N(\theta) = \frac{\theta(1 + \beta) + 2(\beta - 1)\lambda}{(2 - \theta)(1 + \beta) + 4\lambda}.$$

As a result of the separability assumption, this tariff is a dominant strategy for the home country and will be the Nash equilibrium tariff. The noncooperative tariff may be also written as

$$(4) \quad t^N = \frac{\theta(1 + t^N)}{2} + \omega(t^N),$$

where

$$(5) \quad \omega(t) \equiv \frac{\lambda(\beta - 1 - 2t)}{1 + \beta}$$

is the inverse of the elasticity of the foreign export supply schedule, which represents a measure of the home country's market power.

Throughout the paper we will restrict the range of the political pressure parameter so that the unilaterally optimal tariffs are non-prohibitive. In particular, we will assume that  $\theta \in \Theta \equiv [\underline{\theta}, \bar{\theta}]$ ,  $\underline{\theta} \geq 0$ , and  $\bar{\theta} \leq \theta^{\max} \equiv 2(\beta - 1)/(1 + \beta)$ , where  $\theta^{\max}$  denotes the value of the political pressure,  $\theta$ , at which the home country's optimal tariff eliminates trade, i.e.,  $t^N(\theta^{\max}, \lambda) = t^{pro}$ .

The following characteristics of the importer's optimal tariff function follow immediately from differentiation of (3) and will be useful in the analysis below.

**LEMMA 1:** For  $\theta < \theta^{\max}$  and  $\lambda \in (0, 1)$ ,

- (i)  $t_\theta^N(\theta) > 0, t_\beta^N(\theta) > 0, t_\lambda^N(\theta) > 0;$
- (ii)  $\left(\frac{\partial t^N(\theta)}{\partial \beta} / \frac{\partial t^N(\theta)}{\partial \lambda}\right)$  is increasing in  $\theta$ .

The importer's optimal tariff is increasing in the magnitude of the political shock and the home country's market power, as reflected in its size and degree of comparative disadvantage. Part (ii) highlights that the impact of  $\beta$  relative to  $\lambda$  is increasing in the magnitude of the political shock. This results from the fact that the effect of  $\beta$  on market power is increasing in  $t$  and the effect of  $\lambda$  on market power is decreasing in  $t$ , as reflected in (5).

<sup>10</sup>The home welfare,  $V$ , is increasing in  $t$  for  $t < t^N(\theta)$  and decreasing for  $t > t^N(\theta)$ , where  $t^N(\theta)$  is defined by (3).

This may be verified by noting that  $V_t = \frac{\lambda(1 + \beta)(1 - \lambda)(\theta(1 + \beta) + 2(\beta - 1)\lambda - t((2 - \theta)(1 + \beta) + 4\lambda))}{(\beta(1 - \lambda) + \lambda(1 + 2t) + 1)^3}$ .

For the foreign country, welfare is the sum of consumer surplus and firm profits, namely,

$$(6) \quad V^*(t) = S^*(t) + \pi^*(t),$$

where,  $S^*(t) = (1 - \lambda)(1 - p^*(t))^2/2$  and  $\pi^*(t) = (1 - \lambda)\beta p^*(t)^2/2$ . Foreign welfare is decreasing and convex in  $t$ . An increase in the home tariff worsens the terms of trade for the foreign country, which reduces foreign welfare. The convexity of foreign welfare arises because the adverse terms of trade effect is proportional to the volume of foreign exports, and the volume of exports declines with increases in  $t$ .

We assume that the objective of trade negotiators is to maximize the joint welfare of the two governments, defined as  $W(t; \theta) \equiv V(t; \theta) + V^*(t)$ . It can be shown that the joint welfare is quasiconcave in  $t$  for  $\theta \in [0, \theta^{\max}]$ , and it achieves a maximum at<sup>11</sup>

$$(7) \quad t^E(\theta) = \frac{\theta}{2 - \theta}.$$

The efficient tariff is increasing in  $\theta$  for  $\theta \in [0, \theta^{\max}]$ .<sup>12</sup> Moreover, observe that the efficient tariff is independent of country size and the degree of comparative advantage, so the efficient agreement will neutralize all of the market power effects.

## II. The Optimal Cap without an Escape Clause

We now turn to the analysis of trade agreements in settings where the magnitude of the political pressure is the private information of the importing country. We will assume that the distribution of the political shocks in each country is common knowledge, but the realization is observed only by the importing country. We model the optimal trade agreement as the solution to a principal-agent problem in which an uninformed principal (the WTO) is specifying the actions (tariff levels) to be taken by an informed agent (the importing country).

Our analysis proceeds in two steps. First, in this section, we characterize the optimal tariff binding,  $t^B$ , in an agreement that allows the importer to choose any tariff rate  $t \leq t^B$ . The second step is to introduce the possibility of escape, which allows the importing country to exceed its tariff binding if it incurs a monitoring cost,  $c$  (next section). The comparative statics results we obtain are useful for understanding

<sup>11</sup>Derivative of the world welfare with respect to tariff is  $W_t = \frac{\lambda(1 + \beta)(1 - \lambda)(\theta - t(2 - \theta))}{(\beta(1 - \lambda) + \lambda(1 + 2t) + 1)^3}$ . As is clear from this expression, world welfare is increasing for  $t < \frac{\theta}{2 - \theta}$  and decreasing for  $t > \frac{\theta}{2 - \theta}$ . Therefore,  $W$  is quasiconcave and  $t^E(\theta)$  is the jointly optimal tariff.

<sup>12</sup>The preconditions to impose a safeguard measure under the GATT and WTO are surge in imports and substantial injury to the domestic industry, rather than “political pressure.” Nevertheless, as argued by Sykes (2006), declining industries, which usually exert higher political pressure on the governments, are more likely to meet these conditions for a safeguard measure. Therefore, one could argue that the main motivation behind the safeguard clause is to dissipate protectionist pressures from declining industries.

how country characteristics determine the amount of flexibility that is provided to a country in setting its tariff.<sup>13</sup>

Under a tariff binding  $t^B$ , the importing country can choose any tariff  $t \leq t^B$  without violating the agreement. The importer's welfare is increasing in  $t$  for all  $t < t^N(\theta)$ , so the importer will choose an applied tariff of  $\min[t^N(\theta), t^B]$  when the political shock is  $\theta$ . Since the optimal tariff is increasing in  $\theta$ , the importer will choose its optimal tariff for  $\theta \leq \theta^B(t^B)$ , where

$$(8) \quad \theta^B(t^B) = \max \{ \underline{\theta}, t^{N^{-1}}(t^B) \}.$$

If  $t^B > t^N(\underline{\theta})$ , we have  $\theta^B > \underline{\theta}$ , and the tariff will be below the binding for  $\theta \in [\underline{\theta}, \theta^B]$ . We refer to this as a tariff binding agreement with tariff overhang. If  $t^B \leq t^N(\underline{\theta})$ , the importing country's tariff will be at the binding for all states of the world and there is no overhang.

The importer's choice of tariff under the binding can be represented by the state contingent tariff schedule:

$$(9) \quad t(\theta) = \begin{cases} t^B & \text{if } \theta \geq \theta^B(t^B) \equiv \max \{ \underline{\theta}, t^{N^{-1}}(t^B) \} \\ t^N(\theta) & \text{if } \theta < \theta^B(t^B) \end{cases}.$$

Note that a tariff binding is contained in the set of incentive compatible trade agreements since it satisfies

$$(10) \quad V(t(\theta), \theta) - V(t(r), \theta) \geq 0 \quad \text{for all } r, \theta \in \Theta.$$

In state  $\theta$ , the importer prefers its assigned tariff to that it would obtain by reporting a state  $r \neq \theta$ .

We assume that transfers between countries are available ex ante, so that the objective of the trade agreement is to maximize expected world welfare. The optimal tariff binding agreement is obtained by

$$\max_{t^B} E[W] = \int_{\underline{\theta}}^{\theta^B(t^B)} W(t^N(\theta); \theta) f(\theta) d\theta + \int_{\theta^B(t^B)}^{\bar{\theta}} W(t^B; \theta) f(\theta) d\theta,$$

where,  $f(\cdot)$  is the pdf of the political pressure parameter,  $\theta$ .

Noting that  $W(t; \theta) = W(t; 0) + \theta \pi_t(t)$ , the necessary condition for optimality can be expressed as

$$(11) \quad \pi_t(t^B)(1 - F(\theta^B(t^B))) \left[ \frac{W_t(t^B, 0)}{\pi_t(t^B)} + E[\theta | \theta > \theta^B(t^B)] \right] = 0.$$

<sup>13</sup>Beshkar, Bond, and Rho (2015) conduct a similar comparative statics using the inverse of the foreign export supply elasticity as a measure of market power. In this section, we conduct the comparative statics on exogenous parameters of the model, namely,  $\lambda$  and  $\beta$ .

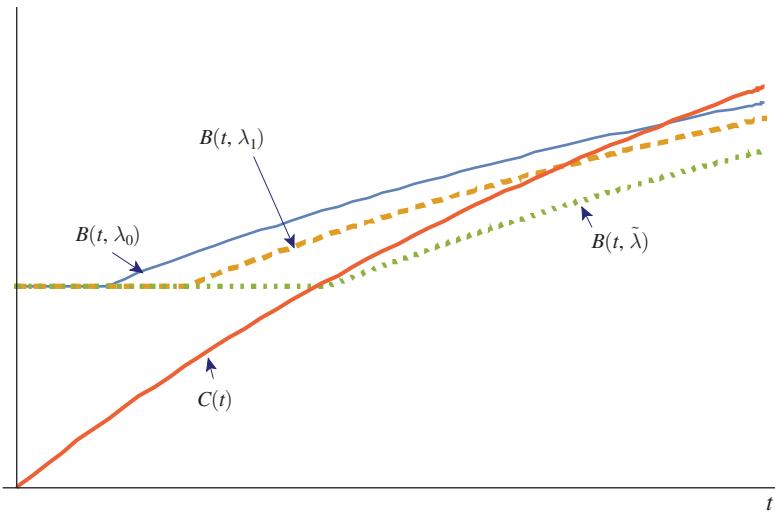


FIGURE 2. BENEFITS AND COSTS OF RAISING TARIFF CAP

This condition will also be sufficient for a maximum if

$$(12) \quad \Lambda^B \equiv \left( \int_{\theta^B}^{\bar{\theta}} W_{tt}(t^N(\theta^B); \theta) f(\theta) d\theta \right) - W_t(t^N(\theta^B); \theta^B) f(\theta^B) \frac{\partial \theta^B}{\partial t^B} < 0.$$

The necessary condition (11) has two types of solutions: one in which the bracketed expression equals 0 and one where  $\theta^B(t^B) = \bar{\theta}$ . It can be shown that the latter solution must be a local minimum if  $\bar{\theta} < \theta^{\max}$ , so we concentrate on the former.

The first term in the bracketed expression in (11) is the deadweight loss per dollar of profit obtained by an increase in the tariff binding, and can be interpreted as the cost of raising the binding. Evaluating this terms using (2), we have  $-W_t(t^B, 0)/\pi_t(t^B) = 2t^B/(1+t^B)$ , which is illustrated by the  $C(t)$  schedule in Figure 2. The cost of raising the binding is increasing in  $t^B$  because the marginal deadweight loss is increasing more rapidly than the marginal profit gain as the binding rises.

The second term in the bracketed expression in (11) is the expected political gain from raising the binding, which is depicted by the locus  $B(t, \lambda, \beta) \equiv E(\theta | \theta \geq \theta^B)$  in Figure 2. This locus will be horizontal at  $E(\theta)$  for  $t^B < t^N(\theta)$  because the binding applies for all  $\theta$ . For  $t^B > t^N(\theta)$ , the  $B$  locus is upward sloping because an increase in  $t^B$  reduces the fraction of states in which the tariff is at the binding. The necessary condition for an optimum will be satisfied at the intersection of these loci. Moreover, in order for an interior solution to represent a maximum, the  $C(t)$  schedule must be steeper than the  $B(t)$  schedule at their intersection.

The optimal tariff binding is decreasing in import market power measures, i.e.,  $\beta$  and  $\lambda$ . To see this, note that  $\theta^B(t^B)$  is decreasing in  $\beta$  and  $\lambda$ . Therefore, an increase in market power will shift the  $B$  schedule in Figure 2 downward, which results in a reduction in the optimal tariff binding at an interior solution.

A closed form solution for the optimal binding may be obtained if we assume that  $\theta$  has a power function distribution, i.e.,

$$(13) \quad f(\theta, \gamma) = \frac{\gamma(\bar{\theta} - \theta)^{\gamma-1}}{(\bar{\theta} - \underline{\theta})^\gamma} \quad \text{for } \theta \in [\underline{\theta}, \bar{\theta}].$$

The power function yields a uniform distribution for  $\gamma = 1$ , with  $f'(\theta) > 0 (< 0)$  for  $\gamma < 1 (> 1)$ . The mean of  $\theta$  is  $\frac{\bar{\theta} + \gamma\underline{\theta}}{1 + \gamma}$ , so larger values of  $\gamma$  result in a lower expected value for the political shock.

**PROPOSITION 1:** Assume that  $\bar{\theta} < \theta^{\max} \equiv 2\left(\frac{\beta-1}{\beta+1}\right)$  and the political pressure parameter has a power-function distribution as given by (13). There will be a unique solution  $t^B \in [0, t^N(\bar{\theta}))$  satisfying (11) and (12) with the following properties:

(i) If  $\lambda < \tilde{\lambda} \equiv \frac{\bar{\theta} - \underline{\theta}}{(1 + \gamma)\theta^{\max} - \bar{\theta} - \gamma\underline{\theta}} < \frac{1}{\gamma}$ , the tariff binding is

$$(14) \quad t^B = \frac{\bar{\theta} - \gamma\lambda\theta^{\max}}{2 - \bar{\theta} - 4\gamma\lambda/(1 + \beta)},$$

and there will be tariff overhang in some states of the world. The optimal binding is decreasing in  $\lambda$ ,  $\beta$ , and  $\gamma$ .

(ii) If  $\lambda \geq \tilde{\lambda}$ , the optimal binding agreement will involve a tariff binding  $t^B = \frac{\bar{\theta} + \underline{\theta}\gamma}{2(\gamma + 1) - (\bar{\theta} + \underline{\theta}\gamma)}$  with no overhang.

(iii) For  $\lambda \leq \tilde{\lambda}$ , the tariff binding agreement is the optimal incentive compatible trade agreement.

Parts (i) and (ii) of Proposition 1 illustrate how the degree of market power affects the amount of flexibility provided in the optimal agreement. For  $\lambda < \tilde{\lambda}$ , there is a unique interior solution for the binding that will result in a positive overhang in some states of the world. In this region, the optimal tariff binding decreases with the market power of the importing country and, as a result, the probability of being at the binding increases with market power.

A corner solution with no overhang occurs if  $\lambda \geq \tilde{\lambda}$ , which is more likely to occur the greater are the market power parameters,  $\beta$  and  $\lambda$ , and the higher is  $\gamma$ . Large values of  $\gamma$  reduce the value of flexibility because they reduce the expected value of the political shock, and thus reduce the value of providing flexibility. Increasing the market power of a country moves its noncooperative tariff further away from the efficient tariff, which raises the cost of providing flexibility. The relationship between market power and the value of flexibility is in line with the observation by Alonso and Matouschek (2008) that an uninformed principal will find it optimal to delegate some decision-making authority to an informed agent only if the preferences of the principal and the agent are sufficiently aligned.

It is worth noting that the optimal binding is declining in the measures of import market power only in the range where some flexibility is provided, i.e.,  $\lambda < \tilde{\lambda}$ . For  $\lambda \geq \tilde{\lambda}$ , where no flexibility is provided under the optimal agreement, the negotiated binding is independent of the import market power. The latter finding is similar to the result of standard trade agreement models that ignore the desire for flexibility.

Part (iii) of Proposition 1 applies the sufficient conditions derived by Amador and Bagwell (2013) for a tariff binding to be the optimal incentive compatible trade agreement to this problem. They considered a symmetric two-country model (i.e.,  $\lambda = 0.5$ ), and showed that a sufficient condition for optimality of tariff caps in that model is  $f'(\theta) \geq 0$ , which is equivalent to  $\gamma \leq 1$  with the power function distribution. We show that in our asymmetric country model, Amador and Bagwell's sufficient conditions for the optimality of a cap are satisfied for all parameter values of our model that are consistent with an interior solution for the cap. In particular, under the power function distribution, this sufficient condition is given by  $\gamma\lambda \leq 1$ .

### III. The Optimal Cap-and-Escape Agreement

The cap-and-escape agreement allows two types of flexibility: unilateral changes in tariffs below the bindings and the use of escape clauses when monitoring costs are incurred. This allows us to examine the extent to which the availability of monitoring substitutes for the use of tariff overhang as a means of providing flexibility in the trade agreement.

We assume that by incurring a monitoring cost of  $c$ , the importing country is able to reveal the true value of  $\theta$  to the rest of the world. We can then specify a trade agreement as consisting of two regions: a monitoring region ( $M \subseteq \Theta$ ) and a non-monitoring region ( $M^C$ ). A country reporting a state in the non-monitoring region is assumed to be subject to a tariff binding, as in the previous section. If the importing country incurs the monitoring cost and a state  $\theta \in M$  is verified, then it receives the tariff  $t^M(\theta)$  that is specified as part of the agreement.

Once the true state is revealed, the importer can impose the tariff  $t^M(\theta)$ . In order for a tariff  $t^M(\theta)$  in the monitoring region to be incentive compatible, the importing country must prefer the payoff it receives from undergoing monitoring to any tariff that it could choose in the non-monitoring region, namely

$$(15) \quad V(t(\theta), \theta) - V(t(r), \theta) \geq c \quad \text{for all } \theta \in M, r \in M^C.$$

For  $\theta \in M^C$ , there is no incentive to choose a report in the monitoring region because the assigned tariff will be the same as if no monitoring had occurred but the cost of monitoring will be incurred.

A cap-and-escape agreement can be characterized by a tariff binding,  $t^B$ , a threshold value,  $\theta^M$ , for the monitoring region,  $M = [\theta^M, \bar{\theta}]$ , and a tariff schedule for the monitoring region,  $t^M(\theta)$ . The potential for such an agreement to improve on the agreement with a tariff binding alone can be seen from the necessary condition for the optimal binding, (11), which shows that the binding will exceed the efficient tariff at  $\theta^B$  and will be less than the efficient tariff in the neighborhood of  $\bar{\theta}$ . For values of  $\theta$  sufficiently high, an increase in the applied tariff would benefit both the

importing country and the world as a whole. Offering a high tariff in the event that a high value of the political shock is verified has the potential to be both welfare improving and incentive compatible if  $c$  is not too large. World welfare can also be improved if tariffs are reduced for low realizations of  $\theta$ , since the efficient tariff is below that specified under the binding. However, monitoring would not be incentive compatible in this case because the importer prefers the tariff offered under the binding to the efficient tariff.

We begin our analysis by establishing the following Lemma, which characterizes the optimal escape rule  $\{\theta^M, t^M(\theta)\}$  given  $t^B$ .

**LEMMA 2:** *Suppose that for a given  $t^B$ , there exists  $\theta^M < \bar{\theta}$ , such that*

$$(16) \quad W(t^E(\theta^M), \theta^M) - c = W(t^B, \theta^M).$$

*Then, given  $t^B$ , the optimal escape rule is given by  $t^M(\theta) = t^E(\theta)$  if  $\theta > \theta^M$ .*

Figure 3 illustrates the form of the tariff schedule under a cap-and-escape agreement as given by Lemma 2. For  $\theta < \theta^M$ , the importer's tariff is determined by the tariff binding. For  $\theta \geq \theta^M$ , the importer incurs the cost of monitoring and receives the efficient tariff, with the boundary of the monitoring region chosen to make world welfare equal under monitoring and the binding. Lemma 2 shows that monitoring occurs less frequently than would be desired by the importing country because  $\theta^M$  exceeds the value of  $\theta$  at which the importing country is indifferent between  $t^B$  and incurring the monitoring costs to obtain the efficient tariff.<sup>14</sup> This is because the importing country's tariff imposes negative externalities on the rest of the world and, hence, the threshold level of  $\theta$  for monitoring to raise world welfare is above the threshold for the importer to gain from monitoring. In particular, we must have  $\theta^B < t^{E^{-1}}(t^B) < \theta^M$ . As a result, an optimal cap-and-escape agreement will specify an efficient tariff for the entire monitoring region because the incentive constraint on monitoring is not binding. Note that this result would continue to hold if part of the monitoring costs were paid by the rest of the world, since this would only have the effect of further relaxing the importer's reporting constraint.

Using equation (16), which determines the boundary of the monitoring region, we can express the problem for designing the optimal cap-and-escape agreement as

$$(17) \quad \max_{t^B} E[W] = \int_{\theta}^{\theta^B(t^B)} W(t^N(\theta), \theta)f(\theta) d\theta + \int_{\theta^B(t^B)}^{\theta^M(t^B, c)} W(t^B, \theta)f(\theta) d\theta \\ + \int_{\theta^M(t^B, c)}^{\bar{\theta}} (W(t^E(\theta), \theta) - c)f(\theta) d\theta.$$

<sup>14</sup>This result is reminiscent of the “serious” injury condition under the WTO agreements on safeguards and antidumping, which precludes the use of contingent protection measures in cases where the magnitude of alleged injury to domestic industries is not sufficiently great.

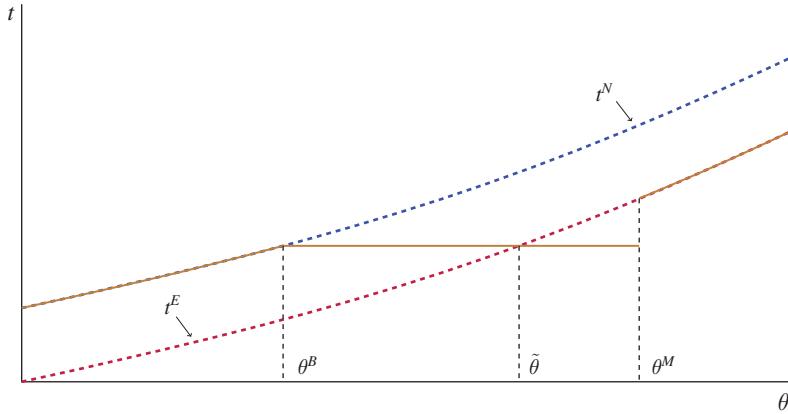


FIGURE 3. THE CAP-AND-ESCAPE AGREEMENT

The necessary condition for optimal choice of binding will be

$$(18) \pi_t(t^B) \left( F(\theta^M(t^B)) - F(\theta^B(t^B)) \right) \left[ \frac{W_t(t^B, 0)}{\pi_t(t^B)} + E[\theta | \theta^M(t^B) > \theta > \theta^B(t^B)] \right] = 0.$$

For cases in which monitoring takes place with  $c > 0$ , we have  $\bar{\theta} > \theta^M(t^B) > \theta^B(t^B) \geq \underline{\theta}$ . Thus, the necessary condition can only be satisfied if the bracketed expression equals 0.

As in the case without monitoring, the bracketed expression requires that the deadweight loss per unit of profit generated by an increase in the binding equal the expected political benefit over the region of shocks where the tariff is at the binding. The necessary conditions allow for two types of solutions that involve the use of monitoring. One type of solution arises if  $\underline{\theta} < \theta^B < \theta^M < \bar{\theta}$ , so that the importer has flexibility in the form of tariff overhang for  $\theta < \theta^B$  and use of the escape clause for  $\theta \geq \theta^M$ . The other type of solution is one in which the escape clause is the only form of flexibility provided to the importer, which arises if  $\theta^B = \underline{\theta}$ .

#### A. Impact of Monitoring Cost

Our first result concerns the impact of the cost of the monitoring on the optimal tariff binding. It is clear from the necessary condition for choice of binding, (18), that the benefit of raising the binding is greater the higher is the upper bound on the binding region,  $\theta^M(t^B, c)$ . Since  $\theta^M$  is increasing in  $c$ , a higher monitoring cost makes a higher binding more attractive because the binding applies for larger values of the political shock. Thus, we obtain a local comparative statics result that the optimal binding will be increasing in  $c$ .

Since expected welfare is not necessarily concave in  $t$ , the local comparative static result is not sufficient to establish a monotonic relationship between the tariff binding and monitoring costs. However, expected welfare is supermodular in  $(t, c)$  because

$$(19) \frac{\partial^2 EW(t^B; c)}{\partial t^B \partial c} = W_t(t^B; \theta^M) f(\theta^M) \left( \frac{\partial \theta^M}{\partial c} \right) \geq 0.$$

Therefore, we can apply the monotone comparative static result of Milgrom and Shannon (1994) to obtain the following result.

**PROPOSITION 2:** *The optimal tariff binding is nondecreasing in the level of monitoring costs.*

Proposition 2 establishes the substitutability between tariff overhang and an escape clause. More specifically, the introduction of an escape clause into a trade agreement facilitates tariff reduction because it provides an alternative form of flexibility.

### B. Impact of Market Power

Our central result relates import market power to the type of flexibility, i.e., overhang versus escape, that is optimal under the cap-and-escape mechanism. Recall that under the cap-only mechanism, a higher market power (as measured by  $\lambda$  or  $\beta$ ) was associated with a lower  $t^B$  and  $\theta^B$ , which implies lower probability of overhang. This result, with some caveat, continues to hold under the cap-and-escape agreement.

**PROPOSITION 3:** *For  $\lambda < 1/2$ , the optimal binding,  $t^B$ , and the monitoring threshold,  $\theta^M$ , are decreasing in  $\lambda$  at an interior solution.*

In contrast to the corresponding comparative statics results under the binding agreement (Proposition 1), the comparative statics under the cap-and-escape agreement is valid only for sufficiently low values of  $\lambda$ . This condition on the comparative statics is due to the fact that the cost of escape (monitoring) is independent from the magnitude of trade policy externality, while for high values of  $\lambda$  the gains from escape are decreasing in  $\lambda$ . An increase in  $\lambda$  has two offsetting effects on the magnitude of gains from monitoring for  $\lambda \geq 1/2$ . First, an increase in  $\lambda$  increases the differential between the noncooperative tariff and the efficient tariff. Second, for values of  $\lambda$  greater than half, an increase in  $\lambda$  decreases the volume of imports and, thus, the gains from monitoring. For sufficiently large values of  $\lambda$ , the latter effect dominates and, thus, monitoring becomes less attractive as a means of providing flexibility.<sup>15</sup> It can be shown that  $t^B$  and  $\theta^M$  would necessarily be increasing in  $\lambda$  for  $\lambda$  sufficiently close to 1.

Proposition 3 implies that at an interior solution, an increase in the market power reduces the range of political parameters under which a positive overhang will be observed and expands the range of political parameters under which the escape clause will be utilized. Therefore,

**COROLLARY 1:** *If  $\lambda$  is sufficiently small, under the optimal cap-and-escape agreement, the likelihood of overhang (escape) is weakly decreasing (increasing) in the import market power.*

<sup>15</sup>Intuitively, the gain from going from the current binding to the optimal binding is related to the volume of trade between the countries, and the volume of trade goes to 0 when an importer is exceedingly large or exceedingly small relative to its trading partner. Thus, in a two country world where one country is arbitrarily large relative to the other, the optimal agreement would have a binding with no overhang for the large country and will leave the tariff of the small country virtually unbound.

According to Proposition 1, large countries (i.e., those with  $\lambda \geq \tilde{\lambda}$ ) are given no flexibility under an optimal binding agreement. The introduction of monitoring with sufficiently low costs provides these countries flexibility in the form of escape. For countries with a lower degree of market power,  $\lambda < \tilde{\lambda}$ , the agreement without monitoring included tariff overhang. For these countries, Proposition 3 implies that the introduction of monitoring substitutes for overhang as a source of flexibility because it must reduce the average amount of tariff overhang in the optimal agreement.

For countries that had overhang under the optimal binding agreement, the introduction of the escape clause may result in an optimal contract that involves both escape and overhang. However, it could also result in a complete switch to an agreement in which there is no tariff overhang and the only form of flexibility is through escape.

### C. Convergence of Preferences and the Coexistence of Overhang and Escape

Thus far we have shown that introduction of monitoring reduces the degree to which overhang is used as a flexibility mechanism under an optimal trade agreement. But how substitutable are overhang and escape as flexibility mechanisms?

It turns out that the degree of substitutability between these two flexibility mechanisms depends on the degree of convergence between global and domestic welfare. Letting  $\Delta(\theta) \equiv t^N(\theta) - t^E(\theta)$  denote the difference between Nash tariff and efficient tariff as a function of the political parameter, we prove:

**PROPOSITION 4:** Defining  $\tilde{\beta}(\theta) \equiv \frac{2 + \theta + 4\sqrt{1 + \lambda}}{2 - \theta}$ :

- (i) *The preferences of the importer and the world are locally convergent at  $\theta$  (i.e.,  $\Delta'(\theta) < 0$ ) if and only if  $\beta < \tilde{\beta}(\theta)$ . For  $\beta < \tilde{\beta}(0) = 1 + 2\sqrt{1 + \lambda}$ , preferences are globally convergent.*
- (ii) *If preferences are globally convergent and  $\theta$  has a uniform distribution, then escape and overhang do not coexist under an optimal cap-and-escape agreement.*

Preferences will be globally convergent if  $\beta$  does not exceed the critical value. Since  $\frac{\partial^2 \omega}{\partial t \partial \beta} > 0$ , larger values of  $\beta$  reduce the rate at which market power declines with  $t$ , which can result in divergence of preferences over some interval. This contrasts with the effect of  $\lambda$ ,  $\frac{\partial^2 \omega}{\partial t \partial \lambda} < 0$ , which exacerbates the decline.

Part (ii) of the proposition shows that if preferences are globally convergent and the distribution of shocks is uniform, there will be a bang-bang solution for agreement type as  $c$  declines. This is established by showing that any interior solution will fail to satisfy the second order conditions if preferences are locally convergent at the optimum. In other words, for a given country size, if the comparative advantage parameter is not too large, flexibility is provided either through overhang or an escape clause, but not both.

#### IV. Generalization

The previous section characterized the optimal cap-and-escape agreement in a competitive model where the international externality from tariff setting operates through the terms of trade and countries are subject to random shocks to the value of protection. In this section, we show that this characterization of the trade-off between tariff overhang and monitoring extends to other forms of international externalities as long as the national welfare functions satisfy two basic assumptions.

Letting  $V(t; \theta)$  denote the payoffs of the importing country, we assume that:

**ASSUMPTION 1:**  *$V(t; \theta)$  is strictly quasi-concave in  $t$  on  $[0, t^P]$ , with  $V_{t\theta} > 0$ . The importer's optimal (noncooperative) tariff on the importable,  $t^N(\theta)$  is uniquely determined with  $\frac{dt^N(\theta)}{d\theta} = -\frac{V_{t\theta}}{V_{tt}} > 0$ .*

Assumption 1 yields a unique optimal tariff and a demand for protection that varies positively with the political shock,  $\theta$ .

Moreover, we assume that:

**ASSUMPTION 2:** *The welfare of the foreign government,  $V^*(t)$ , is decreasing in  $t$  for  $t < t^P$ . Joint welfare of the home and foreign governments,  $W(t; \theta) \equiv V(t; \theta) + V^*(t)$ , is strictly quasi-concave in  $t$ . The state-contingent tariff that maximizes world welfare,  $t^E(\theta)$ , is unique and increasing in  $\theta$ .*

The prisoner's dilemma in international tariff-setting is reflected in the implication of our assumptions that  $t^N(\theta) \geq t^E(\theta)$ , with strict inequality for  $t^N(\theta) < t^P$ .

This more general formulation allows for the possibility that the externality operates through a channel other than the terms of trade. For example, we show in Appendix B that a model of trade under monopolistic competition with a fixed number of firms in each country and consumer preferences as in Melitz and Ottaviano (2008) yields government preferences that satisfy Assumptions 1 and 2.

The property that  $W_{t\theta} > 0$  means that if world welfare can be increased by monitoring at some  $\theta_0 > 0$ , then it can also be increased by monitoring for  $\theta > \theta_0$ . The property that  $V^*(t)$  is decreasing in  $t$  ensures that the incentive compatibility condition will be slack in the monitoring region. Therefore, Assumptions 1 and 2 are sufficient to establish Lemma 2, and the maximization problem for determining the optimal cap-and-escape contract will be given by (17). The necessary condition for the optimal binding will be

$$(20) \quad \int_{\theta^B(t^B)}^{\theta^M(t^B, c)} W_t(t^B; \theta) f(\theta) d\theta = 0.$$

In other words, at the optimal binding, the expected value of raising  $t^B$  over the region where the tariff is at the binding equals 0.

We also have the property that expected welfare is supermodular in  $(t, c)$  because equation (19) is satisfied when Assumptions 1 and 2 hold. The optimal binding will then be nondecreasing in  $c$ .

## V. Empirical Evidence

In this section, we provide evidence for our main theoretical result, which links the type of trade policy flexibility to the level of import market power at the sectoral level. In particular, we show that the probability of positive overhang is decreasing in import market power, while adoption of a safeguard measure is more likely the greater is the import market power.

We use data on safeguards, negotiated tariff bindings, and applied tariffs for 114 countries at the Harmonized System (HS) six-digit level from 1996 to 2009. The safeguard data are obtained from Global Safeguard Database (Temporary Trade Barriers Database 2010) and tariff data are obtained from United Nations Conference on Trade and Development's Trade Analysis and Information System (UNCTAD TRAINS). Our dataset includes 226 safeguard cases of 39 countries (including 10 new WTO members), covering 1,240 sectors. The number of cases that ever had a final/definitive safeguard measure decision of Affirmative or Partial—some products were found affirmative/others negative—is 96, which cover 492 sectors of 23 countries (including 8 new WTO members). Table C1 in Appendix C presents the list of countries using safeguards and the numbers of relevant cases and sectors. It reveals that there is significant variation across countries in the usage of safeguard measures which affect various number of sectors.

As a measure of market power, we use estimates of inverse export supply elasticities for six-digit HS products, which are provided by Nicita, Olarreaga, and Silva (2013). *Sectors using safeguards* is a dummy variable, which has a value of 1 if the sector ever had a final/definitive safeguard measure decision of Affirmative or Partial.

We label a sector as a weakly bound tariff line if a positive tariff overhang has been observed at least once during our sample period.<sup>16</sup> Similarly, we label a sector as safeguard-using, if a safeguard measure has been adopted in the sector at least once.

Before providing evidence at the sector level, we show that our results are supported by aggregate country-level observations. Since our main theoretical results establish a relationship between import market power and negotiated flexibility mechanisms, we focus on import market power as the main explanatory variable. In particular, we use GDP and total imports as alternative measures of market power for countries. We also include a number of other variables that could potentially

<sup>16</sup>The tariff data are available at the HS six-digit level, while the actual tariff lines are at a more disaggregated level. The TRAINS database reports minimum, maximum, and the average of the applied and binding rates of all sectors within an HS six-digit category. Therefore, our definition of tariff overhang (i.e., average applied tariff below the average binding) could lead to erroneous labeling of sectors as weak or strong binding. That is because having the average applied tariff below the average binding does not guarantee a positive overhang in any of the tariff lines under the six-digit category. To ensure that our results are not driven by this measurement error, we confirmed that our results are robust to using other definitions of overhang as a robustness check (not reported).

TABLE 2—COUNTRY-LEVEL EVIDENCE

Dependent var.	Fraction of weakly bound tariff lines		Safeguard-using country	
	Tobit		Probit	
Model	GDP (1)	Imports (2)	GDP (3)	Imports (4)
MP measure #				
Import market power	−0.102 (0.040)	−0.066 (0.035)	0.264 (0.028)	0.165 (0.037)
Developed	−0.045 (0.106)	−0.083 (0.106)	−0.347 (0.128)	−0.206 (0.132)
Political instability index	0.031 (0.025)	0.031 (0.025)	0.010 (0.029)	0.020 (0.034)
New WTO member	−0.362 (0.086)	−0.333 (0.088)	0.262 (0.073)	0.148 (0.090)
Observations	94	94	94	94

Notes: Both market power measures are logged and standardized. Robust standard errors are reported in parentheses.

affect the level of negotiated and applied tariffs. These variables include development status of the countries (binary), political instability index, and a dummy variable that indicates whether a country was an original WTO member or joined as a new member after the WTO was established in 1995.

The country-level regressions indicate that a country is more likely to use safeguards the higher is its GDP or total imports. Moreover, the fraction of weak-binding sectors in a country is negatively correlated with these aggregate market power measures. The impact of aggregate market power measures on the fraction of weak binding sectors is documented in columns 1 and 2 of Table 2. Our Tobit estimates indicate that at the average, a 1 standard deviation increase in  $\ln(GDP)$  decreases the fraction of weak binding sectors by 10 percentage points. This pattern continues to hold when  $\ln(\text{total imports})$  is used as a measure of market power instead of  $\ln(GDP)$ .

Columns 3 and 4 of Table 2 report the result of a probit regression in which the dependent variable is a dummy that indicates whether a country has ever adopted a safeguard measure. A 1 standard-deviation increase in  $\ln(GDP)$  increases the likelihood that the country is a safeguard user by 26 points. Similarly, a 1 standard-deviation increase in total imports increases this likelihood by 16 percentage points. All of these estimated coefficients are statistically significant.

From our secondary explanatory variables, only the “New WTO Member Dummy” has a significant coefficient across all country-level regressions. In particular, we observe that latecomers tend to have fewer sectors with a positive overhang, and they are more likely to use safeguards. These observations may reflect lower bargaining power of countries that were not part of the Uruguay Round and had to join the WTO through accession process for new members.

We now turn to our sector-level evidence. We continue to focus on import market power as our main explanatory variable. As our primary measure of import market power, we use inverse of the estimated foreign export supply elasticity for six-digit

HS sectors, which is provided by Nicita, Olarreaga, and Silva (2013). We also use the country's share of the world import in a given sector as an alternative measure of import market power.

In addition to the measure of market power, we include development status (to capture any political or bargaining differences across developed and developing countries), political instability index (to capture the impact of overall political environment on tariffs), and estimated import demand elasticity as explanatory variables. Demand elasticity is included as it is usually considered a potential factor in the choice of tariffs (Grossman and Helpman 1995) and taxes more generally (Ramsey 1927). Our theory, however, does not establish an unambiguously monotonic relationship between negotiated tariffs and import demand elasticity.<sup>17</sup> We also include dummy variables for 14 categories of industries based on the Harmonized System Product Categories.

The first two columns of Table 3 report the result of probit regressions in which the binary dependent variable takes a value of 1 if the sector has a weak binding. It shows that a tariff line is more likely to be weakly bound the lower is the sector's import market power. In particular, an increase in the market power from the 5 percent to 95 percent of distribution decreases the likelihood of a weak binding by 14 to 30 percentage points depending on the measure of market power.

The results of probit regressions for the use of safeguards are given in columns 3–4 of Table 3. As predicted by our model, the likelihood that a sector uses a safeguard is increasing in its import market power. However, it is worth noting that adopting a safeguard is a rare event. At the fifth percentile of import market power, the likelihood of adopting a safeguard is estimated to be 0.05 percent or 0.2 percent depending on what market power measure is used. At the ninety-fifth percentile of market power, this likelihood increases multiple-fold to 1 percent and 0.7 percent, respectively.

One may argue that low negotiated tariff binding rates lead to higher market power measures, lower likelihood of overhang, and higher likelihood of escape, simultaneously. Therefore, the argument goes, the strong correlation between market power and the likelihood of overhang and escape does not reflect a causal relationship from market power to the type of flexibility mechanism that is utilized. To address this concern, we take an instrumental variable approach. As in Nicita, Olarreaga, and Silva (2013), we use the inverse of the world's weighted export supply elasticity and the import demand elasticity in the rest of the world as an instrument for our market power measures. Columns 5 and 6 of Table 3 report the result of IV estimations. All of the estimated coefficient of market power are negative and statistically significant. Moreover, our instruments are strongly correlated with the market power measures and also pass the overidentification test.

In summary, our empirical evidence suggests that through the cap-and-escape mechanism, the WTO members have retained unilateral flexibility in sectors with little import market power, while in sectors with high import market power flexibility may be obtained through the escape clause. This system of trade policy flexibility

<sup>17</sup>In the case of optimal binding without escape, Beshkar, Bond, and Rho (2015) show that in general the relationship between optimal binding and import demand elasticity is ambiguous.

TABLE 3—SECTOR-LEVEL EVIDENCE

Dependent var.	Weak binding Probit Inv. exp. elas. (1)	Weak binding Probit Imp. share (2)	Escape Probit Inv. exp. elas. (3)	Escape Probit Imp. share (4)	Binding rate IV Tobit Inv. exp. elas. (5)	Binding rate IV Tobit Imp. share (6)
Import market power	-0.043 (0.019)	-0.068 (0.029)	0.308 (0.067)	0.483 (0.117)	-37.558 (8.348)	-10.339 (0.800)
Developed	-0.351 (0.208)	-0.317 (0.202)	0.158 (1.222)	-0.313 (1.098)	1.628 (4.399)	-6.954 (0.886)
pol	0.041 (0.049)	0.036 (0.047)	0.163 (0.276)	0.179 (0.289)	0.473 (0.428)	1.330 (0.095)
Import elasticity	0.008 (0.004)	0.008 (0.004)	-0.038 (0.022)	-0.042 (0.022)	0.576 (0.100)	0.286 (0.020)
Observations	124,391	124,391	118,501	118,501	124,626	124,626
Margins at 5% of MP	0.81	0.89	0.002	0.0005		
Margins at 95% of MP	0.67	0.59	0.007	0.01		
Overid. test ( <i>p</i> -value)					0.3403	0.246

Notes: Semi-elasticity estimates are reported in columns 1–4. Dummies for 14 product categories included in all regressions.

has been achieved by negotiating higher tariff binding rates for sectors with lower market power.

## VI. Conclusions

Our analysis has shown how tariff bindings and contingent protection provide alternative means of introducing flexibility into trade agreements. Tariff overhang allows countries to make unilateral policy changes in response to political shocks, but has the disadvantage that the importing country will always choose a tariff that is higher than the first best tariff. As a result, tariff overhang will be used most extensively when importer preferences are closely aligned with those of the world as a whole.

Contingent protection allows the imposition of tariffs that are efficient from a world point of view and can be useful even when the preferences of the importer diverge significantly from those of the world. However, contingent protection has the disadvantage of requiring the use of resources to verify the state. Our results indicate that allowing contingent protection will result in a substitution of monitoring for tariff overhang as monitoring costs decline. We also showed how this substitution may take a bang-bang form if preferences are sufficiently convergent and shocks are uniform.

We also illustrated how the alignment of preferences relates to market power in a competitive model of international trade, where tariffs impose terms of trade externalities on trading partners. We showed that increases in market power make the preferred tariff of the importing country differ more from that of the world, which makes it less attractive to allow tariff overhang for countries with significant market power. This results in a preference for the use of an escape clause in the case

of countries with market power if absolute country size is not too large, since the tariffs are likely to always be at the binding. In the case of arbitrarily large countries, however, trade volumes may be too low to justify the use of contingent protection.

In the application of the cap-and-escape mechanism to an international trade setting, the preference of the agent (importing country) is always for a higher value of the action variable than that of the principal (world). In other applications, the agent might prefer more extreme values than the principal. The agent's preference might be for higher values of the action for large realizations of the private information and a lower value for low realizations. In that case, one can imagine an agreement that would give discretion to the agent for an interval of actions, with monitoring being introduced at both the upper and lower ends of the distribution of shocks. The extension to other examples of this type remains an area for future work.

## APPENDIX A: PROOFS

### PROOF OF LEMMA 1:

Differentiation of (3) yields

$$\frac{\partial t^N}{\partial \theta} = \frac{2(1 + \lambda)(1 + \beta)^2}{\Lambda} > 0; \quad \frac{\partial t^N}{\partial \beta} = \frac{8\lambda(1 + \lambda)}{\Lambda} > 0;$$

$$\frac{\partial t^N}{\partial \lambda} = \frac{2(1 + \beta)(2(\beta - 1) - (\beta + 1)\theta)}{\Lambda} > 0 \quad \text{for } \theta < \theta^{\max},$$

where  $\Lambda = ((\beta + 1)(2 - \theta) + 4\lambda)^2$ . Part (iii) follows from  $\left(\frac{\partial t^N}{\partial \beta}\right)/\left(\frac{\partial t^N}{\partial \lambda}\right) = \frac{4\lambda(1 + \lambda)}{(1 + \beta)^2(\theta^{\max} - \theta)}$ , which is increasing in  $\theta$  for  $\theta < \theta^{\max}$ . ■

### PROOF OF PROPOSITION 1:

One solution to the necessary condition (11) is to set  $t^B = t^N(\bar{\theta})$ . Note, however, that for  $\bar{\theta} < \theta^{\max}$ , this will represent a local minimum since  $\Lambda^B = -W_t(t^N(\theta^B); \theta^B)f(\theta^B)\frac{\partial \theta^B}{\partial t^B} > 0$ . Therefore, the optimal binding must satisfy  $t^B \in [0, t^N(\bar{\theta})]$ .

Define  $J(t) = E(\theta | \theta \geq \theta^B(t)) - \frac{2t}{1+t}$ , where  $\theta^B(t) = \max \left\{ \underline{\theta}, \frac{2t(1+\beta)+4\lambda(t-t^{pro})}{(1+t)(1+\beta)} \right\}$ . The necessary condition for the optimal binding is  $J(t) = 0$ , which will also be sufficient if  $J'(t) < 0$ .

Using the density function from (13), we have

$$J(t) = \begin{cases} \frac{\bar{\theta} + \gamma\underline{\theta}}{1 + \gamma} - \frac{2t}{1 + t} & \text{if } t \in [0, t^N(\underline{\theta})] \\ \frac{\bar{\theta} - \gamma\lambda\theta^{\max} - t\left(2 - \bar{\theta} - \frac{4\gamma\lambda}{(1 + \beta)}\right)}{(1 + t)(1 + \gamma)} & \text{if } t \in [t^N(\underline{\theta}), t^N(\bar{\theta})] \end{cases}.$$

Observe that  $J(t)$  is a continuous function for  $t \in [0, t^N(\bar{\theta})]$ , with

$$J(t^N(\underline{\theta})) = \frac{\bar{\theta}(1 + \lambda) - \lambda(1 + \gamma)\theta^{\max} - (1 - \gamma\lambda)\underline{\theta}}{(1 + \gamma)(1 + \lambda)}.$$

Since  $J(0) = \frac{\bar{\theta} + \gamma\underline{\theta}}{1 + \gamma} \geq 0$  and  $J(t^N(\bar{\theta})) = \frac{\lambda(\bar{\theta} - \theta^{\max})}{(1 + \lambda)} < 0$  for  $\bar{\theta} < \theta^{\max}$  and  $\lambda > 0$ ,  $J(t) = 0$  will have a solution on  $(0, t^N(\bar{\theta}))$ .

We are now ready to prove each of the three parts of the proposition:

(i) For  $\lambda < \tilde{\lambda} \equiv \frac{\bar{\theta} - \underline{\theta}}{(1 + \gamma)\theta^{\max} - \bar{\theta} - \gamma\underline{\theta}}$ ,  $J(0) > 0$ ,  $J(t^N(\underline{\theta})) > 0$ , and  $J'(t) < 0$  for  $t \in [0, t^N(\underline{\theta})]$ , so there can be no solution to  $J(t) = 0$  on that interval.

Since  $\tilde{\lambda}\gamma < 1$ , we have  $J'(t) = \frac{2(\gamma\lambda - 1)}{(1 + t)^2(1 + \gamma)} < 0$  for  $t \in (t^N(\underline{\theta}), t^N(\bar{\theta}))$ .

There will be a unique solution to  $J(t) = 0$  given by  $t^B = \frac{\bar{\theta} - \gamma\lambda\theta^{\max}}{2 - \bar{\theta} - 4\gamma\lambda/(1 + \beta)}$ .

Differentiation of the optimal binding establishes that it is decreasing in  $\lambda$ ,  $\beta$ , and  $\gamma$ .

(ii) For  $\lambda \geq \tilde{\lambda}$ , we have  $J(0) > 0$ ,  $J(t^N(\underline{\theta})) < 0$ , and  $J'(t) < 0$  for  $t \in [0, t^N(\underline{\theta})]$ . Therefore, there will be a unique solution to  $J(t) = 0$  on that interval which yields a binding  $t^B = \frac{\bar{\theta} + \underline{\theta}\gamma}{2(\gamma + 1) - (\bar{\theta} + \underline{\theta}\gamma)}$ . The binding is increasing in the expected value of the political shock, which is decreasing in  $\gamma$ . To show that there are no solutions to the necessary conditions for  $t \in [t^N(\underline{\theta}), t^N(\bar{\theta})]$ , we establish that  $J(t) < 0$  on this interval. There are two cases to consider. If  $\lambda\gamma < 1$ ,  $J(t) < 0$  follows from the fact that  $J(t^N(\underline{\theta})) < 0$  and  $J'(t) < 0$  on  $[t^N(\underline{\theta}), t^N(\bar{\theta})]$ . If  $\lambda\gamma > 1$ ,  $J(t) < 0$  follows from the fact that  $J(t^N(\underline{\theta})) < 0$ ,  $J(t^N(\bar{\theta})) < 0$ , and  $J'(t) > 0$  on  $[t^N(\underline{\theta}), t^N(\bar{\theta})]$ .

(iii) To show the optimality of the binding contract, we first transform the problem to treat the home profit level as the choice variable. We can use the home profit function and world market clearing condition for the home importable to obtain expressions for home and foreign prices,

$$(21) \quad \tilde{p}(\pi) = \sqrt{\frac{2\pi}{\lambda}}; \quad \tilde{p}^*(\pi) = \frac{1 - 2\sqrt{2\pi\lambda}}{(1 + \beta)(1 - \lambda)}.$$

Substituting these prices into the home country consumer surplus and tariff revenue functions, we obtain an expression for home country welfare,

$$\begin{aligned} v(\pi, \theta) &= \frac{(\sqrt{\lambda} - \sqrt{2\pi})^2}{2} + (1 + \theta)\pi \\ &\quad + \frac{(2\sqrt{2\pi} - \sqrt{\lambda})(\sqrt{\lambda} - \sqrt{2\pi}(1 + \beta - \lambda(\beta - 1)))}{(1 + \beta)(1 - \lambda)}. \end{aligned}$$

Similarly, world welfare is obtained by substituting (21) into the foreign payoff functions and adding to home welfare:

$$w(\pi, \theta) = \frac{\beta(1 - \lambda) - \lambda + 4\sqrt{2\pi\lambda} - 2(\beta(2 - \theta)(1 - \lambda) + \lambda(2 + \theta) + (2 - \theta))\pi}{2(1 + \beta)(1 - \lambda)}.$$

These functions satisfy Assumption 1 in Amador and Bagwell (2013) because they are strictly concave in  $\pi$  and  $v_{\theta\pi} = 1$ .

The Nash and efficient choice of profit levels are

$$\begin{aligned}\pi^N(\theta) &= \frac{2\lambda(1 + \lambda)^2}{(2 + \beta(2 - \theta)(1 - \lambda) - \theta(1 - \lambda) + 6\lambda)^2}, \\ \pi^E(\theta) &= \frac{2\lambda}{(\beta(2 - \theta)(1 - \lambda) - \theta(1 - \lambda) + 2(1 + \lambda))^2}.\end{aligned}$$

Evaluating the necessary condition for an optimum yields

$$\begin{aligned}&\int_{\theta^B}^{\bar{\theta}} w_\pi(\pi^N(\theta^B), \theta) f(\theta) d\theta \\ &= \int_{\theta^B}^{\bar{\theta}} \theta f(\theta) d\theta - \frac{(1 - F(\theta^B))(\theta^B + \lambda\theta^{\max})}{1 + \lambda} = 0.\end{aligned}$$

This can be solved for the optimal threshold value of the political shock at which the binding applies,

$$(22) \quad \theta^B = \frac{(1 + \lambda)\bar{\theta} - (1 + \gamma)\lambda\theta^{\max}}{1 - \lambda\gamma} \text{ for } \lambda \leq \tilde{\lambda}.$$

Amador and Bagwell (2013) identify two sufficient conditions for the case in which the optimal agreement has an interior solution for the tariff binding, namely,

- (c1)  $C(\theta) \equiv \kappa F(\theta) - w_\pi(\pi^N(\theta), \theta) f(\theta)$  is nondecreasing for  $\theta \in [\underline{\theta}, \theta^B]$ ;
- (c2)  $D(\theta) \equiv \kappa(\theta - \theta^B) - \int_{\theta^B}^{\bar{\theta}} w_\pi(\pi^N(\theta^B), z) \frac{f(z)}{1 - F(\theta)} dz \geq 0$  for  $\theta \in [\theta^B, \bar{\theta}]$ , with equality at  $\theta^B$ , where  $\kappa \equiv \inf \frac{w_{\pi\pi}}{v_{\pi\pi}} = \frac{1}{1 + \lambda}$ .

We show that conditions (c1) and (c2) will hold at an interior solution if  $\gamma\lambda < 1$ . Since it was shown in (i) that  $\gamma\lambda < 1$  must hold at any interior solution, the tariff binding is the optimal incentive compatible agreement for any parameter values yielding an interior solution for the binding.

Differentiating (c1) with respect to  $\theta$  and evaluating using the payoff function yields

$$C'(\theta) = \frac{\gamma(\bar{\theta} - \underline{\theta})^{-\gamma}(\bar{\theta} - \theta)^{-2+\gamma} B(\gamma, \theta)}{(1 + \lambda)},$$

where,

$$B(\gamma, \lambda, \theta) = \bar{\theta}(1 - \lambda) - \theta(1 - \gamma\lambda) + \theta^{\max}(1 - \gamma)\lambda.$$

Condition (c1) will be satisfied if  $B(\gamma, \lambda, \theta) \geq 0$  for  $\theta \in [\underline{\theta}, \theta^B]$ . If  $\gamma\lambda < 1$ ,  $B$  will be decreasing in  $\theta$ . Therefore, (c1) will be satisfied if  $B(\gamma, \lambda, \theta^B) \geq 0$ , since this implies  $B(\gamma, \lambda, \theta^B) > 0$  for  $\theta \in [\underline{\theta}, \theta^B]$ . Evaluating using (22) yields  $B(\gamma, \lambda, \theta^B) = 2\lambda(\theta^{\max} - \bar{\theta}) > 0$ .

To establish (c2), note that  $D(\theta^B) = 0$  follows from the definition of  $\theta^B$ . Differentiating  $D(\theta)$  with respect to  $\theta$  gives

$$D'(\theta) = \frac{1 - \gamma\lambda}{(1 + \lambda)(1 + \gamma)},$$

which will be positive for  $\gamma\lambda < 1$ . ■

#### PROOF OF PROPOSITION 2:

To obtain this result, consider the optimal binding rate under a cap-only arrangement, which satisfies the first-order condition (11): the marginal benefit of increasing tariff binding,  $E[\theta | \theta > \theta^B(t^B)]$ , is equal to the marginal cost of increasing the binding,  $-\frac{W_t(t^B, 0)}{\pi_t(t^B)}$ . By introducing escape, however, the expected benefit of increasing the binding will reduce to  $E[\theta | \theta^B(t^B) < \theta < \theta^M(t^B, c)]$ , and, thus, the optimal binding will be lower. ■

#### PROOF OF LEMMA 2:

For  $\theta \leq t^{N^{-1}}(t^B)$ , the only incentive compatible tariff is  $t^N(\theta)$  and, hence, monitoring in this region is not optimal. For  $\theta > t^{N^{-1}}(t^B)$ , monitoring will be incentive compatible if and only if  $V(t^M(\theta), \theta) - V(t^B, \theta) \geq c$ . Since  $W(t^M(\theta); \theta) - W(t^B; \theta) = (V(t^M(\theta); \theta) - V(t^B; \theta)) + (V^*(t^M(\theta)) - V^*(t^B))$  and  $V^*(t)$  is decreasing in  $t$ , any agreement with  $t > t^B$  that raises world welfare is also incentive compatible. Therefore, the monitoring region should consist of all  $\theta$ , such that world welfare can be raised by monitoring. World welfare cannot be improved by monitoring for  $\theta \in [t^{E^{-1}}(t^B), \theta^M]$  because  $\frac{\partial W(t^E(\theta); \theta) - W(t^B; \theta)}{\partial \theta} > 0$  for  $t^E(\theta) > t^B$ . For  $\theta \geq \theta^M$ , world welfare is maximized at  $t^E(\theta)$ . Therefore, since  $t^E(\theta)$  is also incentive compatible for  $\theta \geq \theta^M$ , the optimal escape rule is  $t^M(\theta) = t^E(\theta)$  for  $\theta \geq \theta^M$ . ■

#### PROOF OF PROPOSITION 3:

From the necessary condition for choice of  $\theta^M$  in (20), it can be seen that  $\theta^M$  will be decreasing in  $\lambda$  if

$$W(t^E(\theta^M); \theta^M) - W(t^B; \theta^M) = \int_{t^B}^{t^E(\theta)} W_t(t^B; \theta^M) dt$$

is decreasing in  $\lambda$ . The change in world welfare from a change in the tariff is  $W_t(t; \theta) = \lambda p^*(2 - \theta)(t^E(\theta) - t) \frac{dp}{dt}$ . Substituting from the equilibrium price expressions and differentiating with respect to  $\lambda$  yields

$$W_{t\lambda} = -\frac{(2 - \theta)(t^E(\theta) - t)(1 + \beta)K}{(1 + \beta(1 - \lambda) + \lambda(1 + 2t))^4},$$

where  $K(\lambda) = (1 + \beta - 4(1 + t)\lambda + (1 + 2t - \beta)\lambda^2)$ . A sufficient condition for  $\frac{\partial \theta^M}{\partial \lambda} < 0$  is that  $K(\lambda) > 0$  for all  $t \in [t^B, t^E(\theta)]$ . Since  $K(\lambda)$  is decreasing in  $t$ , a sufficient condition for  $K(\lambda) > 0$  for all  $t$  in that interval is that  $K(\lambda) \geq 0$  when evaluated at  $t^E(\theta)$ . Note that  $K$  is independent of  $\theta$ , so the most stringent test occurs at the prohibitive tariff,  $t^{pro} = (\beta - 1)/2$ , which yields the requirement that  $\lambda \leq 0.5$ . Solving for  $K(\lambda) = 0$  gives the solution

$$\bar{\lambda}(t) = \frac{0.5\sqrt{(3 + \beta^2 + (6 - 2\beta)t + 4t^2)} - 1 - t}{t^{pro} - t}.$$

Combining this result with the necessary condition for choice of  $\theta^B$ , we have the result that  $t^B$  and  $\theta^M$  are decreasing in  $\lambda$ . ■

#### PROOF OF PROPOSITION 4:

(i) Differentiating  $\Delta$  yields

$$\Delta'(\theta) = \frac{2\lambda[\beta^2(2 - \theta)^2 - 2\beta(4 - \theta^2) - 4(3 + 4\lambda - \theta) + \theta^2]}{(2 - \theta)^2((\beta + 1)(2 - \theta) + 4\lambda)^2}.$$

The sign of this expression is determined by the sign of the bracketed expression in the numerator, which will be increasing in  $\beta$  because  $2(2 - \theta)[2(\beta - 1) - (\beta + 1)\theta] > 0$  for  $\theta < \theta^{\max}$ . The bracketed expression will equal 0 at  $\beta = \frac{2 + \theta + 4\sqrt{1 + \lambda}}{2 - \theta}$ . Therefore, preferences are convergent if and only if  $\beta < \tilde{\beta}(\theta) \equiv \frac{2 + \theta + 4\sqrt{1 + \lambda}}{2 - \theta}$ .

(ii) In the case of a uniform distribution, the necessary condition for an interior solution for the binding requires that

$$(23) \quad \frac{\theta^M + \theta^B(t^B)}{2} - \frac{2t^B}{1 + t^B} = 0,$$

where  $\theta^B(t^B)$  is given by (8). Differentiating with respect to  $t^B$  and using the fact that  $\frac{\partial \theta^B}{\partial t^B} = \frac{2(1 + \lambda)}{(1 + t^B)^2}$ , this condition will also be sufficient if

$$(24) \quad \frac{1 - \lambda}{(1 + t^B)^2} > \frac{1}{2} \frac{\partial \theta^M(t^B, c)}{\partial t}.$$

Differentiating the condition for determining the boundary of the monitoring region yields

$$(25) \quad \frac{\partial \theta^M}{\partial t} = \frac{2G(\theta^M)^2}{[1 + \beta(1 - \lambda) + \lambda(1 + 2t)][(4 - \theta^M)(\beta + 1)(1 - \lambda) + 8\lambda + t(G(\theta^M) + 4\lambda)]},$$

where,  $G(\theta^M) \equiv (\beta + 1)(2 - \theta^M)(1 - \lambda) + 4\lambda$ .

Solving (23) yields the optimal binding as a function of  $\theta^M$ :

$$(26) \quad t^B(\theta^M) = \frac{\theta^M(1 + \beta) - 2\lambda(\beta - 1)}{(2 - \theta^M)(1 + \beta) - 4\lambda}.$$

Differentiation of (26) establishes that  $t^B(\theta^M)$  is decreasing in  $\beta$ . Substituting (26) and (25) into (24) yields the requirement for an interior solution to be a local maximum,

$$(27) \quad \frac{((\beta + 1)(2 - \theta^M) - 4\lambda)^2}{4(\beta + 1)^2(1 - \lambda)} > \frac{((\beta + 1)(2 - \theta^M) - 4\lambda)^2 G(\theta^M)^2}{2(\beta + 1)^3(1 - \lambda)^2(2 - \theta^M)A(\theta^M)},$$

where  $A(\theta) \equiv (\beta + 1)(2 - \theta^M)(2 - \lambda) + 4\lambda$ . This condition will be satisfied if

$$(28) \quad Z(\theta^M, \beta) = (\beta + 1)(1 - \lambda)(2 - \theta^M)A(\theta^M) - 2G(\theta^M)^2 > 0.$$

It follows from (28) that  $Z(\theta^M, \beta)$  is continuous in  $\beta$ , with  $\frac{\partial^2 Z}{\partial \beta^2} = 2\lambda(1 - \lambda)(2 - \theta^M)^2 > 0$ . Therefore, to show that  $Z(\theta^M, \beta) < 0$  for  $\beta \in (1, \tilde{\beta}(0))$  it is sufficient to show that  $Z(\theta^M, 1) < 0$  and  $Z(\theta^M, \tilde{\beta}(0)) < 0$ . Calculating these terms yields

$$Z(\theta^M, 1) = -4\lambda((2 - \theta^M)(4 + \theta^M) + \theta^M\lambda(2 + \theta^M)) < 0,$$

and

$$\begin{aligned} Z(\theta^M, \tilde{\beta}(0)) \\ = -16\lambda(1 + \lambda^2 + (1 - \lambda)\sqrt{1 + \lambda}) \\ - 4\lambda\theta^M(1 - \lambda)(2(1 + 2\lambda + \sqrt{1 + \lambda}) - \theta^M(1 + \sqrt{1 + \lambda})^2). \end{aligned}$$

To show that  $Z(\theta^M, \tilde{\beta}(0)) < 0$ , note that since  $\frac{\partial^2 Z(\theta^M, \tilde{\beta}(0))}{\partial (\theta^M)^2} = 8\lambda(1 - \lambda) \times (1 + \sqrt{1 + \lambda})^2 > 0$ , it is sufficient to show that  $Z(0, \tilde{\beta}(0)) < 0$  and  $Z(\theta^{\max}, \tilde{\beta}(0)) < 0$ . The former condition holds because  $1 + \lambda^2 + (1 - \lambda)\sqrt{1 + \lambda} > 0$ . The latter condition holds because  $\theta^{\max}(\tilde{\beta}(0)) = 2\sqrt{1 + \lambda}/(1 + \sqrt{1 + \lambda})$ , which yields  $Z(\theta^{\max}, \tilde{\beta}(0)) = -32\lambda$ . Therefore, there can be no interior optimum for  $\beta < \tilde{\beta}(0)$ . ■

## APPENDIX B: A MONOPOLISTIC COMPETITION MODEL

In this Appendix, we show that a simple model of international trade with differentiated products also satisfies Assumptions 1 and 2.

Consider an economy with a homogeneous sector, 0, and  $I$  differentiated-product sectors,  $i = 1, \dots, I$ , each of which populated by an exogenously given number of domestic and foreign firms, denoted by  $n_i$  and  $n_i^*$ , respectively. We assume the following consumer preferences as in Melitz and Ottaviano (2008):

$$(29) \quad U = q_0 + \sum_i \left( \alpha \int_0^{N_i} q_i(j) dj - \frac{\gamma}{2} \int_0^{N_i} q_i(j)^2 dj - \frac{\eta}{2} \left( \int_0^{N_i} q_i(j) dj \right)^2 \right),$$

where,  $q_i(j)$  is the consumption of variety  $j$  from sector  $i$ ,  $q_0$  is consumption of the numeraire good, and  $N_i \equiv n_i + n_i^*$ .

The consumer preferences in (29) yield the following inverse demand function for the product of a representative firm:

$$(30) \quad p = p_{\max} - \gamma q,$$

where, the choke price,  $p_{\max}$ , is given by

$$p_{\max} = \frac{\alpha\gamma + \eta N \bar{p}}{\eta N + \gamma},$$

and  $\bar{p} = \frac{1}{N} \int p_i di$  is the average price for the sector.

We assume that the differentiated products are produced under monopolistic competition by homogeneous firms that have a fixed unit-labor requirement of  $c$ . Moreover, the homogeneous-product sector, 0, is perfectly competitive and produces one unit of output per unit of labor.

Units of labor are chosen such that it requires one unit of labor to produce one unit of the numeraire good in each country. We assume that the homogeneous product is traded freely and the population is sufficiently large such that in the equilibrium both countries produce the homogeneous product. As a result, the equilibrium wage will be equal to one in both countries regardless of any tariffs that might be applied in the differentiated-product sectors.

Since wages are independent of tariffs, the tariff policy in one differentiated sector has no spillover on other differentiated sectors. As a result, without loss of

generality within this framework, we can focus on a single differentiated sector and drop the sectoral subscript in the subsequent discussion.<sup>18</sup>

We assume that the governments can apply an ad valorem tariff of  $t$  on imports and let  $\tau \equiv 1 + t$ . To follow the literature on international trade with differentiated product, we assume that the import tariff is imposed on the marginal cost of production,  $c$ , in a way similar to iceberg transport cost in trade models. However, while iceberg transport cost is a waste, import tariffs generate revenues for the government of the importing country. These revenues are transferred to the consumers in a lump sum fashion.

In the equilibrium with an import tariff of  $\tau$ , price and quantity of representative home and foreign firms are given by

$$p = \frac{p_{\max} + c}{2}, \quad q = \frac{L}{2\gamma}(p_{\max} - c),$$

$$p^* = \frac{p_{\max} + \tau c}{2}, \quad q^* = \frac{L}{2\gamma}(p_{\max} - \tau c),$$

where  $L$  is the population of the home country. Moreover, the profits of home and foreign firms from sales in the home country are given by

$$\pi = \frac{L}{4\gamma} (p_{\max} - c)^2, \quad \pi^* = \frac{L}{4\gamma} (p_{\max} - \tau c)^2.$$

The equilibrium choke price is given by

$$p_{\max} = \frac{2\alpha\gamma + \eta c(n + \tau n^*)}{2\gamma + \eta N}.$$

An increase in  $\tau$  increases the choke price, which reflects the reduced competitiveness of the market as a result of tariffs. As a result of a higher tariff, the profits of the home (foreign) firms increase (decrease). Therefore, tariffs shift profits from foreign firms to domestic firms. The prohibitive level of tariffs,  $\tau^{\text{proh}}$ , solves  $p_{\max} = \tau c$ , or

$$\tau^{\text{proh}} = \frac{2\alpha\gamma + \eta cn}{2c\gamma + \eta cn}.$$

We assume that the political shock is captured as a weight on firm profits, as in the case of the perfectly competitive model. In particular, we assume that the political payoffs of the home government is given by

$$V(\tau; \theta) = S(\tau) + (1 + \theta)n\pi(\tau) + T(\tau),$$

<sup>18</sup>Note that, as shown by Beshkar and Lashkaripour (2017), in a more general setting in which wages depend on tariffs, welfare functions are supermodular in tariffs. Thus, in general we cannot focus on tariffs of a single differentiated sector.

where  $S$ ,  $\pi$ , and  $T$  are consumer surplus, profits, and tariff revenues, respectively. It could be shown that

$$V(\tau; \theta) = \frac{L}{8\gamma} \left( (3 + 2\theta)n(p_{\max} - c)^2 + n^*(p_{\max} - \tau c)(p_{\max} + (3\tau - 4)c) \right).$$

Moreover,  $V_\tau(1; \theta) > 0$  and  $V_{\tau\tau}(\tau; \theta) < 0$ , and  $V_{\tau\theta} > 0$ . Therefore, this differentiated-product model of international trade satisfies Assumption 1. The non-cooperative (Nash) tariff,  $\tau^N$ , which solves  $V_\tau(\tau^N; \theta) = 0$ , is increasing in  $\theta$ .

The world welfare, i.e., the joint welfare of the governments, is given by

$$W(\tau; \theta) \equiv V(\tau; \theta) + n^* \pi^*(\tau),$$

which is concave in  $\tau$  and, thus, satisfies Assumption 2. Moreover, the efficient tariff,  $\tau^E(\theta)$ , which is the solution to  $W_\tau(\tau; \theta) = 0$ , is increasing in  $\theta$ , as in the competitive case.

Since the political welfare functions that are implied from a differentiated-product model satisfy Assumptions 1 and 2, we conclude that our analysis of the Cap-and-Escape agreement under competitive markets extends to a monopolistic competition market with a fixed number of firms.

## APPENDIX C: TABLES

TABLE C1—COUNTRIES THAT ADOPTED SAFEGUARD MEASURES BETWEEN 1995 AND 2012

Country	Number of cases with an A or P decision	Number of HS6 products covered	Import volume per affected products
USA	7	170	32,277.1
Turkey	12	91	1,818.7
European Union	3	91	21,694.8
China	1	80	11,048.5
Indonesia	11	47	191.1
India	12	46	1,392.5
Chile	9	32	474.3
Jordan	5	29	69.5
Argentina	5	25	583.4
Philippines	7	14	80.5
Brazil	2	13	14.3
Ecuador	4	10	71.7
Rep. of Korea	2	7	299.3
Egypt	4	7	78.5
Rep. of Moldova	1	4	0.1
Dominican Rep.	2	4	17.8
Morocco	2	3	36.7
Croatia	1	2	146.4
Panama	1	2	8.3
South Africa	1	2	41.8
Thailand	1	1	4.4
Kyrgyzstan	1	1	1.3

Note: Total import volume is calculated using 2007 data and reported in millions of dollars.

## REFERENCES

- Alonso, Ricardo, and Niko Matouschek.** 2008. "Optimal Delegation." *Review of Economic Studies* 75 (1): 259–93.
- Amador, Manuel, and Kyle Bagwell.** 2013. "The Theory of Optimal Delegation with an Application to Tariff Caps." *Econometrica* 81 (4): 1541–99.
- Bagwell, Kyle, and Robert W. Staiger.** 1990. "A Theory of Managed Trade." *American Economic Review* 80 (4): 779–95.
- Bagwell, Kyle, and Robert W. Staiger.** 1999. "An Economic Theory of GATT." *American Economic Review* 89 (1): 215–48.
- Bagwell, Kyle, and Robert Staiger.** 2005. "Enforcement, Private Political Pressure, and the General Agreement on Tariffs and Trade/World Trade Organization Escape Clause." *Journal of Legal Studies* 34 (2): 471–513.
- Baldwin, Richard.** 1987. "Politically realistic objective functions and trade policy PROFs and tariffs." *Economic Letters* 24 (3): 287–90.
- Beshkar, Mostafa.** 2010a. "Optimal remedies in international trade agreements." *European Economic Review* 54 (3): 455–66.
- Beshkar, Mostafa.** 2010b. "Trade skirmishes safeguards: A theory of the WTO dispute settlement process." *Journal of International Economics* 82 (1): 35–48.
- Beshkar, Mostafa.** 2016. "Arbitration and Renegotiation in Trade Agreements." *Journal of Law, Economics, and Organization* 32 (3): 586–619.
- Beshkar, M., and E. W. Bond.** 2016. "The Escape Clause in Trade Agreements." In *Handbook of Commercial Policy*, Vol. 1B, edited by Kyle Bagwell and Robert W. Staiger, 69–106. Amsterdam: North-Holland.
- Beshkar, Mostafa, and Eric W. Bond.** 2017. "Cap and Escape in Trade Agreements: Dataset." *American Economic Journal: Microeconomics*. <https://doi.org/10.1257/mic.20160218>.
- Beshkar, Mostafa, Eric W. Bond, and Youngwoo Rho.** 2015. "Tariff binding and overhang: Theory and evidence." *Journal of International Economics* 97 (1): 1–13.
- Beshkar, Mostafa, and Ahmad Lashkaripour.** 2017. "Interdependence of Trade Policies in General Equilibrium." Center for Applied Economics and Policy Research (CAEPR) Working Paper 2017-003.
- Bond, Eric W., and Jee-Hyeong Park.** 2002. "Gradualism in Trade Agreements with Asymmetric Countries." *Review of Economic Studies* 69 (2): 379–406.
- Bown, Chad P.** 2005. "Participation in WTO Dispute Settlement: Complainants, Interested Parties, and Free Riders." *World Bank Economic Review* 19 (2): 287–310.
- Grossman, Gene M., and Elhanan Helpman.** 1995. "Trade Wars and Trade Talks." *Journal of Political Economy* 103 (4): 675–708.
- Horn, Henrik, Giovanni Maggi, and Robert W. Staiger.** 2010. "Trade Agreements as Endogenously Incomplete Contracts." *American Economic Review* 100 (1): 394–419.
- Johnson, Harry G.** 1953. "Optimum Tariffs and Retaliation." *Review of Economic Studies* 21 (2): 142–53.
- Kucik, Jeffrey, and Eric Reinhardt.** 2008. "Does Flexibility Promote Cooperation? An Application to the Global Trade Regime." *International Organization* 62 (3): 477–505.
- Ludema, Rodney D., and Anna Maria Mayda.** 2013. "Do terms-of-trade effects matter for trade agreements? Theory and evidence from WTO countries." *Quarterly Journal of Economics* 128 (4): 1837–93.
- Maggi, Giovanni, and Andres Rodriguez-Clare.** 1998. "The Value of Trade Agreements in the Presence of Political Pressures." *Journal of Political Economy* 106 (3): 574–601.
- Maggi, Giovanni, and Andrés Rodríguez-Clare.** 2007. "A Political-Economy Theory of Trade Agreements." *American Economic Review* 97 (4): 1374–1406.
- Maggi, Giovanni, and Robert W. Staiger.** 2015. "Optimal Design of Trade Agreements in the Presence of Renegotiation." *American Economic Journal: Microeconomics* 7 (1): 109–43.
- Melitz, Marc J., and Giancarlo I. P. Ottaviano.** 2008. "Market Size, Trade, and Productivity." *Review of Economic Studies* 75 (1): 295–316.
- Milgrom, Paul, and Chris Shannon.** 1994. "Monotone Comparative Statics." *Econometrica* 62 (1): 157–80.
- Nicita, Alessandro, Marcelo Olarreaga, and Peri Silva.** 2013. "Cooperation in WTO's Tariff Waters." Université de Genève Department of Economic Sciences Working Paper 13061.
- Ossa, Ralph.** 2011. "A 'New Trade' Theory of GATT/WTO Negotiations." *Journal of Political Economy* 119 (1): 122–52.

- Park, Jee-Hyeong.** 2011. "Enforcing International Trade Agreements with Imperfect Private Monitoring." *Review of Economic Studies* 78 (3): 1102–34.
- Pelc, Krzysztof J.** 2009. "Seeking Escape: The Use of Escape Clauses in International Trade Agreements." *International Studies Quarterly* 53 (2): 349–68.
- Ramsey, F. P.** 1927. "A Contribution to the Theory of Taxation." *Economic Journal* 37 (145): 47–61.
- Shaffer, Gregory.** 2003. "How to Make the WTO Dispute Settlement System Work for Developing Countries: Some Proactive Developing Country Strategies." International Centre for Trade and Sustainable Development (ICTSD) Resource Paper 5.
- Shavell, Steven.** 2006. "On the Writing and the Interpretation of Contracts." *Journal of Law, Economics, and Organization* 22 (2): 289–314.
- Sykes, Alan O.** 2006. *The WTO Agreement on Safeguards: A Commentary*. Oxford: Oxford University Press.
- Temporary Trade Barriers Database.** 2014. World Bank. <http://go.worldbank.org/W5AGKE6DH0>.
- Townsend, Robert M.** 1979. "Optimal contracts and competitive markets with costly state verification." *Journal of Economic Theory* 21 (2): 265–93.
- Venables, Anthony J.** 1987. "Trade and Trade Policy with Differentiated Products: A Chamberlinian-Ricardian Model." *Economic Journal* 97 (387): 700–717.